

# Satsense: a python library for land-use and land-cover classification of earth observation data

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## Satsense

Satsense is an open source Python library for patch based land-use and land-cover classification, initially developed for a project on deprived neighborhood detection. However, many of the algorithms made available through Satsense can be applied in other domains, such as ecology and climate science.

Satsense provides:

- Easy use of satellite images
- A number of standard features
- Parallel feature extraction
- Performance evaluation metrics
- Convenience functions for shape/mask files

Easy installation through pip:

➤ `pip install satsense`

Read the documentation online at <https://satsense.readthedocs.io>

## Features

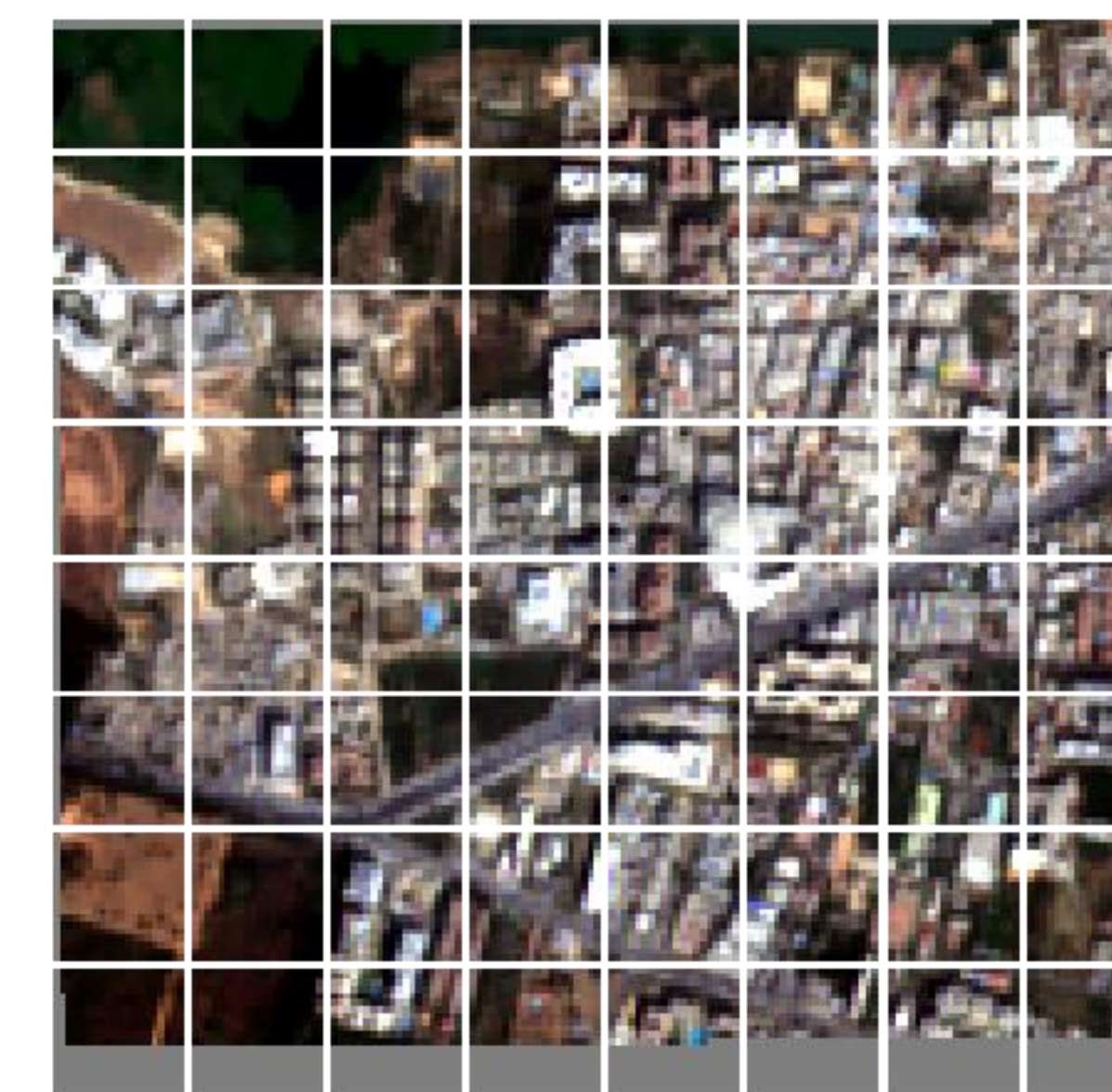
The following features are available

- Histogram of Oriented Gradients
- Built-up presence Index: Pantex
- Normalized Difference Indices: NDVI, NDSI, NDWI, WVSI
- Lacunarity
- Scale Invariant Feature Transform (SIFT)
- Texton
- **Contribute your own!**

## Patch Generation

Using our generators you can extract patches from the satellite image for your own calculations. Such patches can be used to calculate features on a local scale.

Our feature extraction methods use a block grid approach similar to [1] that extracts features at various scales and assigns them to each block.



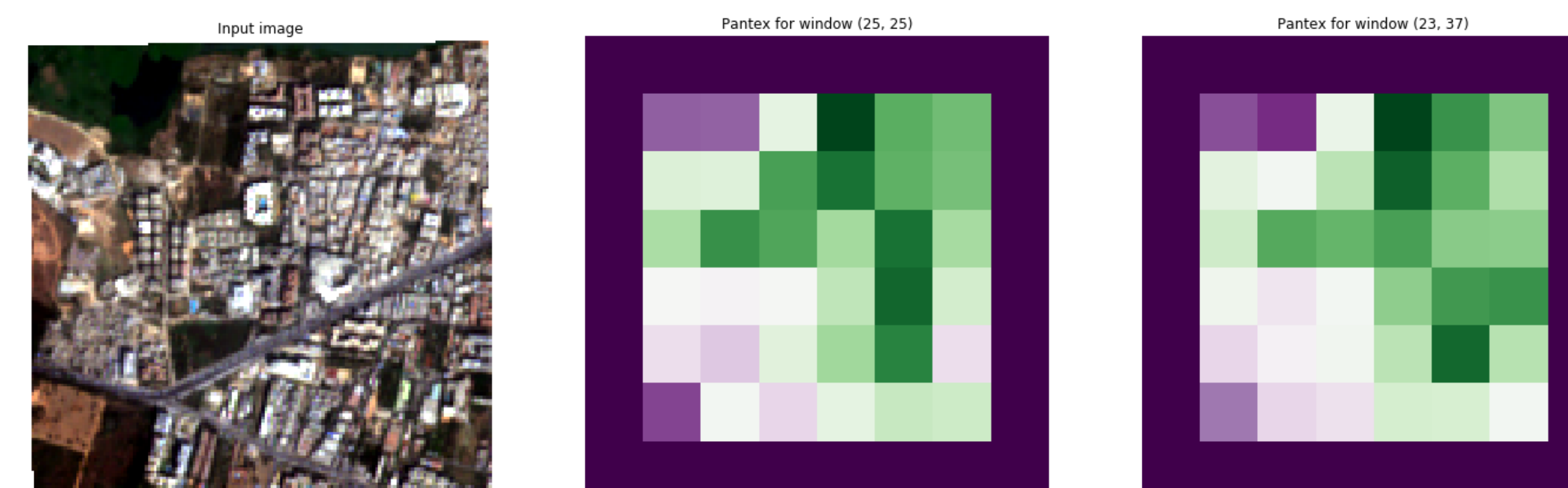
Example output of a patch generator

[1] Graesser, Jordan, et al. "Image based characterization of formal and informal neighborhoods in an urban landscape." IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing 5.4 (2012): 1164-1176.

## Feature Extraction

We provide an easy to use method to extract features from a satellite image, including a parallel implementation that works well for very large satellite images.

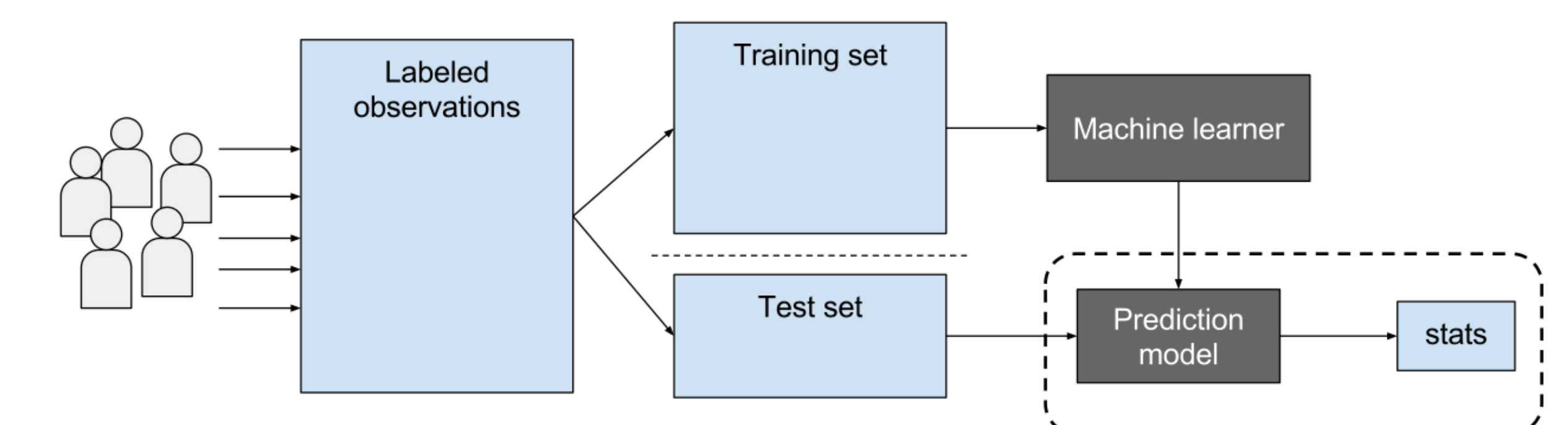
The result of feature extraction can be saved in GeoTIFF and NetCDF formats and are readily usable in for instance QGIS. These can then be used for further processing, for instance machine learning.



Example output of pantex feature extraction

## Machine Learning

After feature extraction machine learning techniques, such as those provided by the scikit-learn package, can be used with the calculated features to train a classifier.

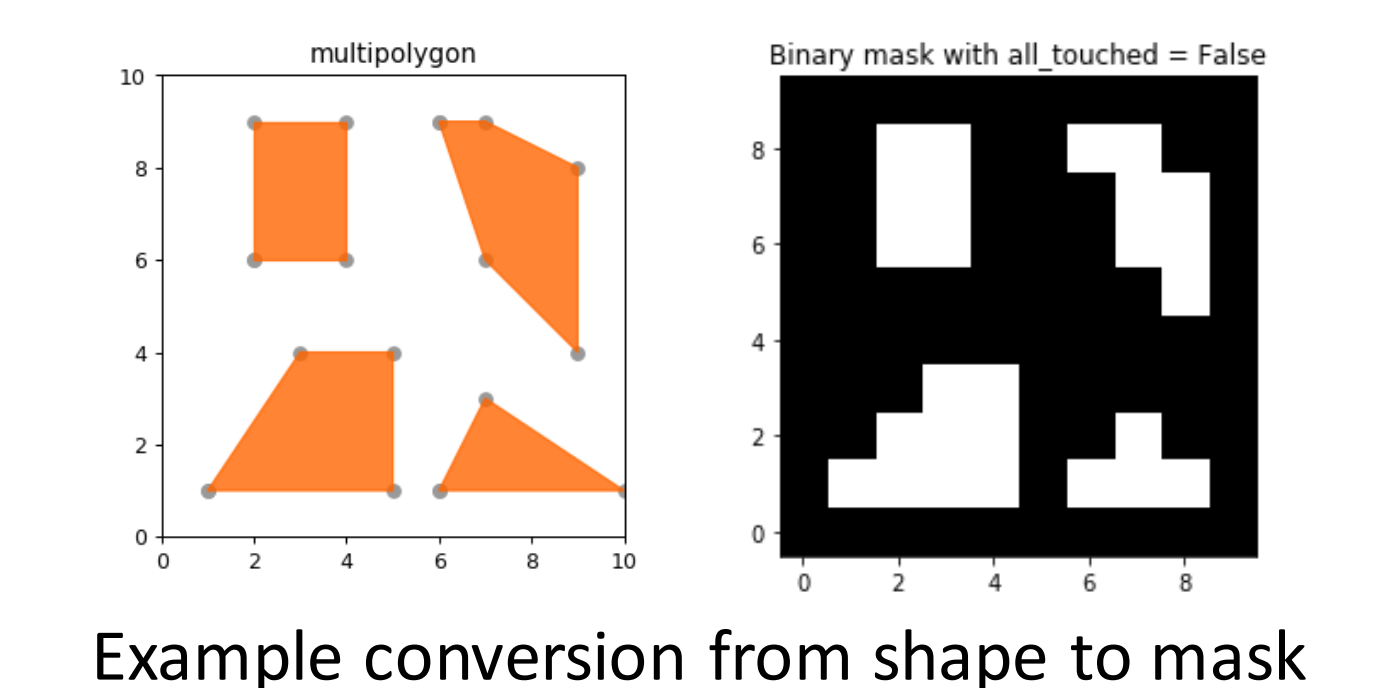


Supervised machine learning in a nutshell, Image by: EpochFail (CC BY-SA 4.0) on <https://commons.wikimedia.org/wiki/>

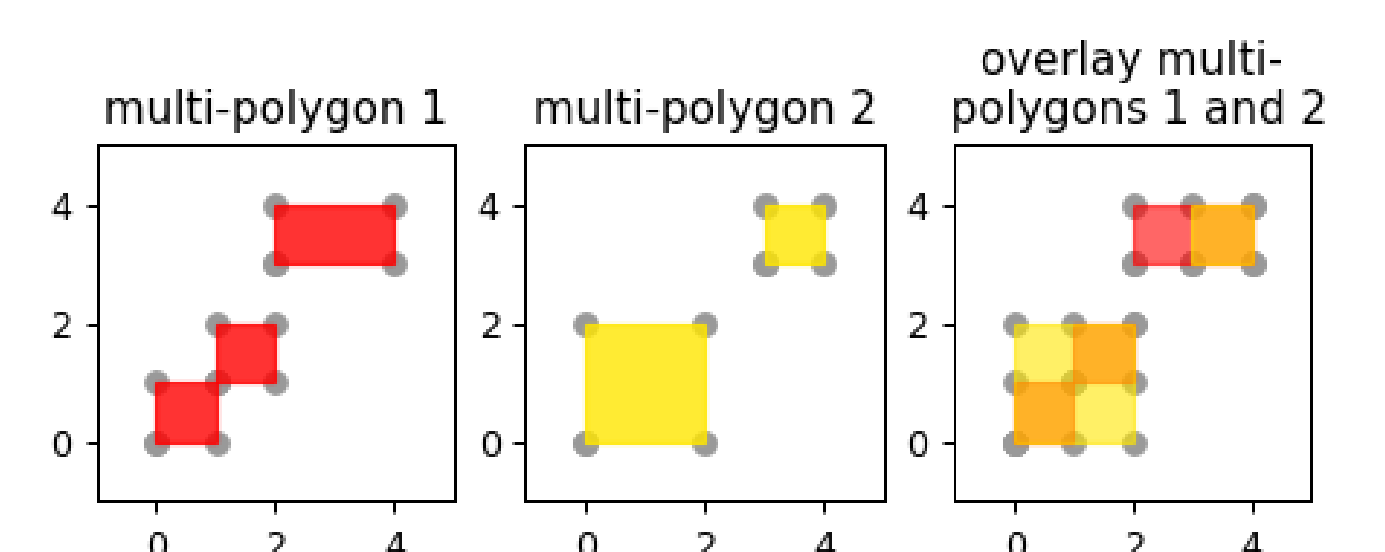
## Performance Evaluation

Performance evaluation metrics are a work in progress.

We currently provide convenience methods for converting shapefiles to masks and vice-versa and Jaccard Similarity Index metric for either shapefiles or mask files.

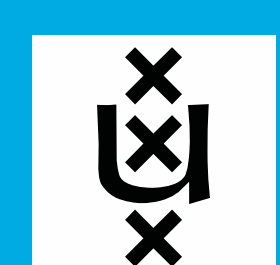


Example conversion from shape to mask



The area of the intersection between the 2 multi-polygons is 3.0  
The area of the union between the 2 multi-polygons is 6.0  
The Jaccard index between the 2 multi-polygons is 0.5

Illustration of Jaccard Index



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